Architects and engineers have, to my mind, honorable roles in building things. Life-threatening, property-threatening forces of compression, thrust, and the like need serious countermeasures.

- AutoCAD Grandad
Spread (Column) Footing

- The widened part of a foundation that spreads a column load over a broader area of soil

- Design based on
  - Soil Bearing Capacity
  - Column Load
Column Loads

- Roof Loads
- Supported Floor Loads
- Weight of the Column
- Weight of the Foundation

Note: If the ground floor is a slab-on-grade, the loads are not included.
Sizing a Spread Footing

Size based on:

- The total load applied to the soil
- The allowable soil bearing capacity

The pressure applied due to the total load must be less than or equal to the allowable bearing capacity.
Soil Bearing Pressure

\[ q = \frac{P}{A} \]

Where \( q \) = Soil bearing pressure
\( P \) = Load applied
\( A \) = Area of the footing
# Soil Bearing Capacities

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Allowable Soil Bearing (lb/ft²)</th>
<th>Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEDROCK</td>
<td>4,000 to 12,000</td>
<td>Poor</td>
</tr>
<tr>
<td>GRAVELS</td>
<td>3,000</td>
<td>Good</td>
</tr>
<tr>
<td>GRAVELS w/ FINES</td>
<td>3,000</td>
<td>Good</td>
</tr>
<tr>
<td>SAND</td>
<td>2,000</td>
<td>Good</td>
</tr>
<tr>
<td>SAND W/ FINES</td>
<td>2,000</td>
<td>Good</td>
</tr>
<tr>
<td>SILT</td>
<td>1,500</td>
<td>Medium</td>
</tr>
<tr>
<td>CLAYS</td>
<td>1,500</td>
<td>Medium</td>
</tr>
<tr>
<td>ORGANICS</td>
<td>0 to 400</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Required Footing Area

\[ q_{\text{allowable}} \geq q \]

\[ q_{\text{allowable}} \geq \frac{P}{A} \]

\[ A \geq \frac{P}{q_{\text{allowable}}} \]

Where \( q_{\text{allowable}} = \) Allowable soil bearing pressure
Net Allowable Bearing Pressure

\[ pt_{\text{footing}} = 150 \times \text{footing} \]

\[ q_{\text{net}} = -q_{\text{allowable}} \]

\[ A \geq \frac{P_{\text{column}}}{q_{\text{net}}} \]

\[ \frac{\text{lb}}{\text{ft}^3} \]

1 ft²
Required Footing Area
Using Net Allowable Soil Bearing Pressure

\[ A \geq \frac{P_{\text{column}}}{q_{\text{net}}} \]
Example

Size a spread footing for Column B-3 in the building shown below. The footing thickness is 1 ft 9 in. Assume that the footings bear on silty sand with an allowable soil bearing pressure of 3000 psf.
Example
Partial 2nd Floor Framing 3D View
Example
Partial 2nd Floor Framing

Column B-3
Assume that an engineer has performed analyses for the floor and roof members with the following results:

- Roof Beam Reaction = 5,000 lb
- Roof Girder Reaction = 10,000 lb
- 2nd Floor Beam Reaction = 13,500 lb
- 2nd Floor Girder Reaction = 27,000 lb
Roof
Interior Beam End Reaction x 2
= (5,000 lb) 2 = 10,000 lb
Interior Girder End Reaction x 2
= (10,000 lb) 2 = 20,000 lb

2nd Floor
Interior Beam End Reaction x 2
= (13,500 lb) 2 = 27,000 lb
Interior Girder End Reaction x 2
= (27,000 lb) 2 = 54,000 lb

Column Weight = 1,500 lb

TOTAL COLUMN LOAD = 112,500 lb
Calculate the Net Allowable Soil Bearing Pressure

\[ p_{footing} = t_{footing} \cdot 150 \frac{lb}{ft^3} \]

\[ p_{footing} = (1.75 \text{ ft}) \left( 150 \frac{lb}{ft^3} \right) = 262.5 \text{ psf} \]

\[ q_{net} = q_{allowable} - p_{footing} \]

\[ q_{net} = 3000 \text{ psf} - 262.5 \text{ psf} = 2737.5 \text{ psf} \]
Required Footing Area

\[ A \geq \frac{P_{col}}{q_{net}} \]

\[ A \geq \frac{112,500 \text{ lb}}{2737.5 \frac{\text{lb}}{\text{ft}^2}} \]

\[ A \geq 41.1 \text{ ft}^2 \]
Footing Shape

\[ A_{\text{square}} = x^2 \]

\[ A_{\text{rectangle}} = bh \]

\[ A_{\text{circle}} = \pi r^2 \]
Square Footing Size

\[ A_{\text{square}} = x^2 \]

\[ 41.1 \text{ ft}^2 = x^2 \]

\[ x = \sqrt{41.1 \text{ ft}^2} = 6.4 \text{ ft} \]

Use 6'-6" x 6'-6" x 1'-9" thick
Round Footing Size

\[ A_{\text{circle}} = \pi r^2 \]

\[ 41.1 \text{ ft}^2 = \pi r^2 \]

\[ r^2 = \frac{41.1 \text{ ft}^2}{\pi} \]

\[ r^2 = 13.1 \text{ ft}^2 \]

\[ r = \sqrt{13.1 \text{ ft}^2} = 3.6 \text{ ft} \]

Say 3ft 9in. radius

Use 7' - 6" diameter x 1' - 9" thick